

**Appendix L**

**Trail Standards and Specifications**

# TRAIL STANDARDS AND SPECIFICATIONS

Information found in this appendix was compiled from various resources including the Bozeman Area Master Plan, the 1995 Bozeman Area Trail System: *Main Street to the Mountains*, City of Bozeman Parks Department, and City of Bozeman Department of Planning and Community Development.

## Definitions

**ADA:** Americans with Disabilities Act. (Standards yet to be adopted)

**Cleared Zone:** The minimum distance on both sides of the tread and the air space above that is cleared of obstructions and maintained to facilitate passage and insure safety of trail users.

**Full Access:** For any allowable use; barrier free.

**Geo-textile:** A synthetic woven or non-woven textile used to reinforce and support trail surface materials and to enhance drainage.

**Guidelines:** Practices that are not required yet highly desirable.

**Tread:** Trail surface meant for actual foot, ski, and/or wheel contact.

**Trail Easement:** Side boundaries within which activities or structures are excluded that would interfere with or are incompatible with the use or purpose of the trail.

**Specifications:** Specific construction and material requirements.

**Surfaced Trail:** Trail with the tread hardened with a compacted aggregate mixture, asphalt, or concrete paving. The tread surface must be resistant to wear and erosion providing all-weather non-dusty passage. An aggregate mixture meeting specifications for Class I trails is given in Appendix L-1, Part 1.

**Unsurfaced Trail:** Trail with a tread consisting of vegetation and soil, wood chips, or of gravel.

**Natural Fines:** Preferred surfacing material consisting of 3/8 inch minus gravel with 15% clay binder.

## Trail Use Classification and Characteristics

Trails are classified as to the intensity and type of use. As changes dictate, a trail may be upgraded in classification to meet new user demands.

**Class I** - Heavily used, generally full access, multiple non-motorized use, main corridor trails designed for recreational and commuter use. Designed to permit two-way traffic using a wide

surfaced tread, or parallel treads; one surfaced and the other unsurfaced. ADA degree of access: easier.

**Class II** - Moderate use, multiple non-motorized use, local and connector trails designed for commuter and recreational use. Class II trails are not specifically designed for full access and may or may not be surfaced. ADA degree of access: moderate.

**Class III** - Low use, long distance connector trails designed primarily for recreational use by hikers and all-terrain bicycles. Trails limited to pedestrian traffic in sensitive locations, such as wetland nature education areas. Trails are designed to minimum standards striving for low maintenance and minimal disturbance to the natural setting. ADA degree of access: difficult to most difficult.

## **Trail Design Standards**

### Class I Trails

1. Single surfaced tread with a minimum width of eight feet. Parallel treads (surfaced and unsurfaced) will have minimum widths of eight feet and four feet, respectively. Tread width may be reduced to 36 inches for a maximum distance of 10 feet to pass or preserve significant features such as rock formations, important vegetation, etc.
2. Tread surface will be asphalt, concrete, pavers set on concrete, wood decking, natural fines, or a well maintained compacted crushed gravel mixture meeting the aggregate specification in Appendix L-1, Part 1. The tread material including any base course will have a total minimum thickness of six inches. Wood deck planks must be run perpendicular to the direction of travel and joints must not exceed 36 inch. Planks must be securely fastened so they do not warp.
3. The minimum cleared zone will be tread width plus 2 feet to either side of the tread and 10 feet vertical.
4. Maximum sustained running grade is 5%. A 10% maximum grade is allowed for a maximum distance of 30 feet.
5. Tread will be raised above adjacent surfaces and have a 1 to 2 inch crown. Where this requirement is not possible, the tread will have a 1 to 20 cross slope and/or side ditches outside the cleared zone. Stream crossings will be over culverts or bridges. Only dips or slot-entrance drainpipe will be used for crosstread water stops.
6. Wood chips are not an acceptable tread material for Class I trails.
7. Geo-textile material as specified in Appendix L-1, Part 5, will be placed beneath the tread material in poorly drained, boggy or marshy areas, or wet meadows and on any of the following soil types; clays, clayey loams, silts, silty loams, or loess.
8. Adequate visibility for safety.
9. The minimum acceptable trail easement width is 25 feet.
10. Trail entrances will be signed describing the degree of ADA access.
11. All above items may be modified to meet current ADA specifications.

## Class II Trails

1. Single surfaced or unsurfaced tread, five foot minimum width. Tread width may be reduced to 32 inches for a maximum distance of 30 feet to pass or preserve significant features such as rock formations, important vegetation, etc.
2. A gravel or particulate tread surface will be a minimum of six inches thick. Native soil tread is acceptable only where the soil will allow all-weather use with minimal environmental impact. Class II trails or portions of trails designed for ADA access will be surfaced with a minimum of wood decking as described under Class I, natural fines, or with a well maintained compacted crushed gravel meeting the aggregate specifications in Appendix L-1, Part 1.
3. The minimum cleared zone will be tread width plus one foot horizontal, and ten feet vertical.
4. Grades will be 15% or less. Class II trails or portions of trails designed for ADA access will have a maximum sustained running grade of 8% and a 14% maximum grade is allowed for a maximum distance 50 feet.
5. Tread will be raised above the adjacent surfaces and have a 4 inch crown. Where this requirement is not possible the tread will have a 1 to 20 cross slope and/or side ditches outside the cleared zone. Stream crossings will be over culverts or bridges. Only dips, slot-entrance drain pipe, or rubber belting will be used for cross-tread water stops.
6. Wood chips are not an acceptable tread material for Class II trails.
7. Geo-textile material as specified in Appendix L-1, Part 5 will be placed beneath any gravel or particulate tread material in poorly drained, boggy or marshy areas, or wet meadows and on any of the following soil types; clays, clayey loams, silts, silty loams, or loess.
8. Adequate visibility for safety.
9. The minimum acceptable trail easement width is 25 feet.
10. Trail entrances will be signed describing the degree of ADA access.
11. All above items may be modified to meet current ADA specifications.

## Class III Trails

1. Single tread of a minimum 18 inch width. Class III trails or portions of trail designed for ADA access will be a minimum width of 28 inches.
2. No surfacing is required except in erosion prone poorly drained, boggy or marshy areas, or wet meadows.
3. The minimum of cleared zone will be the tread width horizontally and seven feet vertically.
4. Maximum of 20% grades unless restricted by erosive soils, etc. Class III trails or portions of trails designed for ADA access will have a maximum sustained running

grade of 12% and a 20% maximum grade is allowed for a maximum distance of 50 feet.

5. Utilize grade dips, cross sloping, and water bars to minimize erosion.
6. Blending the trail into the setting is emphasized in trail routing.
7. The minimum acceptable trail easement width is 25 feet.
8. Wood chip tread materials are acceptable when traffic is limited to pedestrian traffic in sensitive locations such as in wetland nature education areas.
9. All above items may be modified to meet current ADA specifications.

Summary of Design Standards for All Trails or Portions  
of Trails Designed as ADA Accessible

<u>FEATURE</u>	<u>CLASS I</u>	<u>CLASS II</u>	<u>CLASS III</u>
ADA Degree of Access:	Easier	Moderate	Difficult
clear width (minimum)	120 inches	72 inches	36 inches
sustained running grade <sup>1</sup> (maximum):	5 percent	8 percent	12 percent
maximum grade allowed: for a maximum distance of:	10 percent 30 feet	14 percent 50 feet	20 percent 50 feet
cross slope <sup>2</sup> (maximum): <sup>3</sup>	3 percent	5 percent	8 percent
passing space interval (maximum): <sup>4</sup>	200 feet	300 feet	400 feet
rest area interval (maximum):	400 feet	900 feet	1200 feet

Note 1: No more than 20% of the total trail length shall exceed the sustained running grade.

Note 2: Cross slope may not exceed 3% in maximum grade segments, or 5% in maximum grade segments on difficult access trails.

Note 3: The measurement of maximum grade and cross slope should be made over a 24" measurement interval to correspond to the footprint of a wheelchair operating in that environment.

Note 4: Passing spaces are not required for trail tread widths of 5 feet or greater.

## Trail Design Guidelines

**Trail Corridors** - The trails are to be routed so as to maintain a natural setting, to avoid unnecessary disturbance to private landowners adjacent to the trail and to preserve wildlife habitat and important vegetation. While the minimum acceptable trail easement is 25 feet, the more practical and desirable easement width is 35 feet except in riparian areas where it is 100 feet.

**Road Crossings** - Road crossings should occur at points of good visibility, perpendicular to the roadway (if possible), and at natural crossings, if possible. Full access sections should be equipped with curb cuts.

**Signage** - Class I trails should be signed at road crossings and all other public access points with signs that define uses and restrictions. Class II and III trails should be signed only at the main entrances. These signs should describe uses, trail surface conditions, limitations, such as ADA degrees of access.

## Trail Maintenance Standards

The intent of these maintenance standards is to maintain the trails to their design standards, for public safety, and for meeting ADA access requirements.

### Class I Trails

1. The clear 2 foot minimum clear zone on either side of the tread will be mowed a minimum of 3 times per year. Nominally, mowing will be done once per month in June, July or August, and in September. Late fall mowing may be needed for trails being used for skiing. Mowing times should be chosen to maximize weed control.
2. Gravel tread surfaces will be reconditioned a minimum of twice annually to reincorporate loose surface gravel, to uproot vegetation growing in the tread as an alternative to chemical control, to reshape the tread surface for drainage, and to regrade and recompact the tread surface for ADA access and public safety.
3. Noxious weed control in the trail corridors will be by hand pulling, cutting, burning or biological control. Chemical control will be used only as the last resort.
4. Class I trails will be inspected at least quarterly to insure timely maintenance of the tread surface, erosion controls, signage, fencing, drainage, and of any structural features such as benches, bridges, etc. Inspections should be made at critical times of the seasons, such as during thaws, chinooks, or heavy runoff periods.

### Class II Trails

1. The clear 1 foot minimum clear zone on either side of the tread will be mowed a minimum of 3 times per year. Nominally, mowing will be done once per month in June, July or August, and in September. Late fall mowing may be needed for trails being used for skiing. Mowing times should be chosen to maximize weed control.

2. Gravel tread surfaces will be reconditioned a minimum of biannually to reincorporate loose surface gravel, to uproot vegetation growing in the tread as an alternative to chemical control, to reshape the tread surface for drainage, and to regrade and recompact the tread surface for public safety and ADA access.
3. Noxious weed control in the trail corridors will be by hand pulling, cutting, burning, or biological control. Chemical control will be used only as -the last resort.
4. Class II trails will be inspected at least quarterly to insure timely maintenance of the tread surface, erosion controls, signage, fencing, drainage, and of any structural features such as benches, bridges, etc. Inspections should be made at critical times of the seasons, such as during thaws, chinooks, or heavy runoff periods.

### Class III Trails

1. Vegetation growing in the tread or overhanging the edge of the tread will be cut or mowed twice per year at times determined to be the most beneficial for safe passage of the public.
2. Tread that has been surfaced with particulate materials (i.e. gravel, crushed brick, wood chips) will be reconditioned by replenishing the surface material and by raking as needed.
3. Erosion controls will be maintained in an effective condition.
4. Class III trails will be inspected at least twice annually to insure timely maintenance especially of the erosion controls. Inspections should be made at critical times, such as during the spring thaw or heavy runoff periods.

## Appendix L-1 Trail Construction & Material Specifications

1. Aggregates for Class I Trails will meet the following requirements:
  - a. Aggregate surfacing materials shall be free from injurious quantities of vegetable matter, balls of clay, frozen lumps, or other extraneous matter.
  - b. No combination of shale, clay, coal, or soft particles shall exceed 3.5% by weight.
  - c. The material shall be evenly graded.
  - d. The material shall contain enough binder fines for good compaction.
  - e. The liquid limit for that portion of the fine aggregate passing the No. 40 sieve shall not exceed 25 and the plasticity index shall be between 5 and 10.
  - f. A tolerance of 5%, by weight, up to the next above specified gradation (for example: 1/2 inch for 3/8 inch max) will be allowed.
  - g. Upon approval of the Engineer, small quantities of gravel which contain oversize material may be placed on the trail surface. The gravel so placed shall then be mechanically worked (raked) to remove the oversize rock which shall be gathered and removed from the project or used for erosion control.
  - h. All material shall be furnished with a written certification from an approved testing laboratory stating that the material proposed for use meets or exceeds the requirements of these specifications.
  - i. The material will meet the following gradations

Percentage by Weight Passing Square Mesh Sieves

Passing	Crushed Top Surfacing	Crushed Base Course	Pit Run Gravel Base Course
3 inch sieve			
2 inch sieve			100 %
1 inch sieve		100%	
1/2 inch sieve			
3/8 inch sieve	100 %		
No. 4 sieve	50-80 %	25-60%	
No. 10 sieve	35-70%		
No. 200 sieve	8-15 %	6-12%	10-15%

2. Asphalt for Class I Trails: (to be completed as needed)
3. Concrete for Class I Trails: (to be completed as needed)
4. Acceptable aggregate or particulate surfacing materials for Class II and Class III Trails are:
  - a. Preferred - "Natural fines", "3/8 inch minus with binder fines".
  - b. Acceptable - Well graded road mix with a maximum particle size of 1/2 inch and a maximum 15% by weight of fines passing the No. 200 sieve.
    - Railroad cinders.
    - Crushed brick with a maximum particle size of 1/4 inch.
    - Old existing gravel roads and railway beds with greater than 3/4 inch oversize removed from the surface.

c. Special - Wood chips are acceptable for only Class III trails limited to pedestrian traffic in sensitive locations, such as in wetland nature education areas.

5. Geo-textiles for all Classes of Trails:

- a. The preferred geo-textile is a continuous filament non-woven needle-punched engineering geo-fabric.
- b. An acceptable geo-textile is a woven engineering geo-fabric.
- c. Minimum geo-textile requirements:

<u>Property</u>	<u>Non-woven</u>	<u>Woven</u>
Mass per unit area (ASTM D-3776)	4 oz/sqyd	N/A
Thickness (ASTM D-1777)	60 mils	N/A
Flow Rate (ASTM D-449)	100 gpm/sqft	40 gpm/sqft
Puncture Resistance (ASTM D-3787)	50 lbs	70 lbs
Trapezoid Tear Strength (ASTM D-4533)	40 lbs	45 lbs
Grab Tensile Elongation (ASTM D-4632)	100 lbs@60%	140 lbs@15%

## **Specifications for Pedestrian Bridges** **(ADA compliance)**

1. Minimum width shall be no less than 36 inches for bridges 20 feet or less in length
2. Minimum width shall be 72 inches, if length of bridge exceeds 20 feet, to allow wheelchair turn around and passing
3. Height of bridge is measured from bridge deck to bottom of stream or river
4. If height of bridge is more than 30 inches, a protective rail is required
5. Rails are to be 42 inches high, with at least one midrail at 34 inches, to be used as a handrail
6. Rails must have a protective barrier, with spacing being no more than 4 inches at any point
7. All bridges to be installed on public lands must be certified by a licensed civil or structural engineer
8. If bridge does not require a rail, it must have a 4 inch high curb on, both sides, along entire length of bridge
9. Deck should be constructed of slip-resistant material
10. Deck of bridge shall not exceed a 12 to 1 slope along any part of it's length
11. The deck surface between the ends of the bridge shall not vary from a flat plane by greater than 1/2inch
12. Cross slope of the deck shall not exceed 3%

## **Trail Construction Handout**

Specifications for Class II trails.

1. Trail width shall be a minimum of 60 inches (5 feet)
2. Trail bed must be excavated 4 to 6 inches deep, prior to installation of tread mix
3. Geo-textile weed mat is optional, depending onto what the tread mix is applied (see #7, Class I and II Trail Design Standards above)
4. Tread mix shall be 3/8th inch minus gravel (natural fines) with 15% clay binder
5. If mix does not contain enough clay binder, additional clay must be mixed in
6. Tread mix must be rolled and compacted after installation, maintaining 4 inch crown (If moisture content is not adequate for compaction, water should be added prior to rolling and compacting)
7. All damage to surrounding features and/or vegetation shall be reclaimed immediately
8. Encroaching weeds, due to trail construction, shall be treated and controlled for a minimum of 2 years after trail section is completed